OIPE JC22
AUG 19 2004
PATENT & TRADEMARK OFFICE

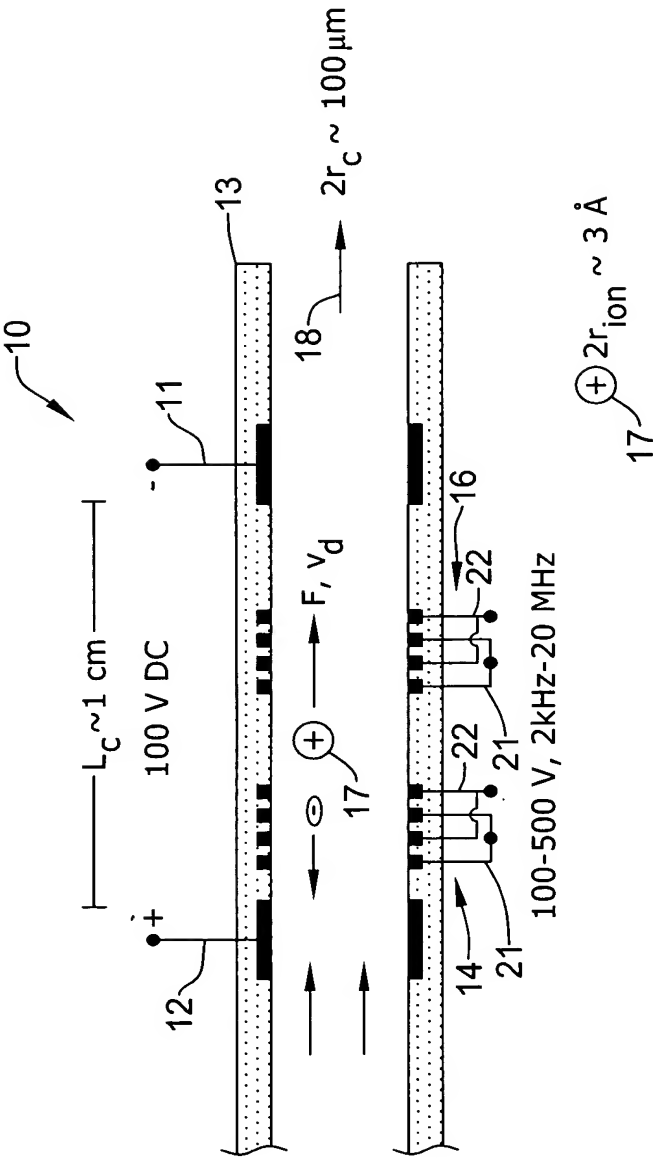

Figure 1

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Applied Pot. V	Ion mol Fraction	Gas Velocities for Ls=Le cm/s	Ls cm/s	Re(Ls) -	△p(Ls) psid	Qohmic mW	Ion+Flow Qvisc mW	Qgen mW	Qvisc+Qgen Qtotal mW	Qideal mW
* 100	1.000E-12	0.01	0.00	0.000	0.000010	0.0000000	1.238E-12	0.000001	1.11E-06	1.238E-12
Ion Radius, rion cm	3.162E-12	0.04	0.00	0.000	0.000031	0.0000001	1.238E-11	0.000003	3.51E-06	1.238E-11
* 1.50E-08	1.000E-11	0.12	0.00	0.000	0.000097	0.0000002	1.238E-10	0.000011	1.11E-05	1.238E-10
Cap.Radius, rc cm	3.162E-11	0.37	0.01	0.001	0.000307	0.0000005	1.238E-09	0.000035	3.51E-05	1.238E-09
* 0.005	1.000E-10	1.18	0.02	0.002	0.000971	0.0000017	1.238E-08	0.000109	1.11E-04	1.238E-08
Field Length, Le cm	3.162E-10	3.72	0.07	0.005	0.003072	0.0000053	1.238E-07	0.000346	3.51E-04	1.238E-07
* 1	1.000E-09	11.76	0.24	0.016	0.009715	0.0000168	1.238E-06	0.001095	1.11E-03	1.238E-06
Tot.Cap.Length,Ls cm	3.162E-09	37.20	0.74	0.050	0.030721	0.0000531	1.238E-05	0.003465	3.53E-03	1.238E-05
* 50	1.000E-08	117.62	2.35	0.159	0.097147	0.0001684	0.00012	0.010996	0.01	0.0001
Eion, Ioniz.Energy eV	3.162E-08	371.96	7.44	0.502	0.307206	0.0005383	0.00124	0.035152	0.04	0.0012
* 70	1.000E-07	1176.23	23.52	1.586	0.971472	0.0017605	0.01238	0.114973	0.13	0.0124
	3.162E-07	3719.57	74.39	5.016	3.072064	0.0061508	0.12379	0.401686	0.53	0.1238
	1.000E-06	11762.30	235.25	15.863	9.714720	*0.0252860	*1.23797	1.651345	*2.91	*1.2379
	3.162E-06	37195.66	743.91	50.163	30.720642	0.1383175	12.37871	9.033049	21.55	12.3787
	1.000E-05	117623.02	2352.46	158.628	97.147201	1.0209592	123.78713	66.675372	191.48	123.7871

Drift Vel. in cm/s, vd=	461.747
NA, Avogadro Num. in 1/cm3=	2.8830E+19
q,Electronic Charge in Cb=	1.6022E-19

*1

Figure 2

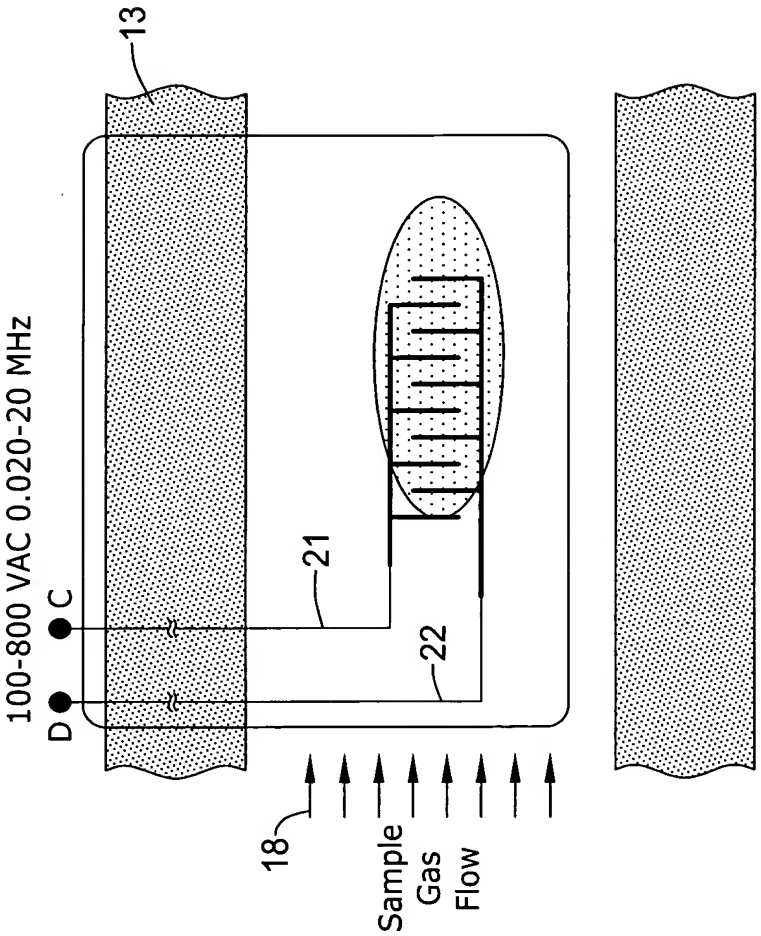

Figure 3

Electron Affinities and Electron Configurations

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Element	Electron Affinity (kJ/mol)	Electron Configuration	Ionization Energies (kJ/mole)
H	72.8	$1s^1$	1300
He	<0	$1s^2$	2400
Li	59.8	[He] $2s^1$	
Be	<0	[He] $2s^2$	
B	27	[He] $2s^2 2p^1$	
C	122.3	[He] $2s^2 2p^2$	1050
N	<0	[He] $2s^2 2p^3$	
O	141.1	[He] $2s^2 2p^4$	1300
F	328.0	[He] $2s^2 2p^5$	
Ne	<0	[He] $2s^2 2p^6$	

Figure 4

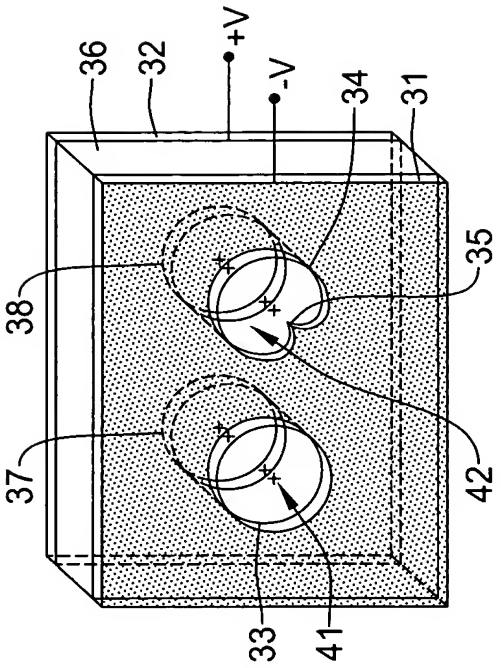

Figure 5

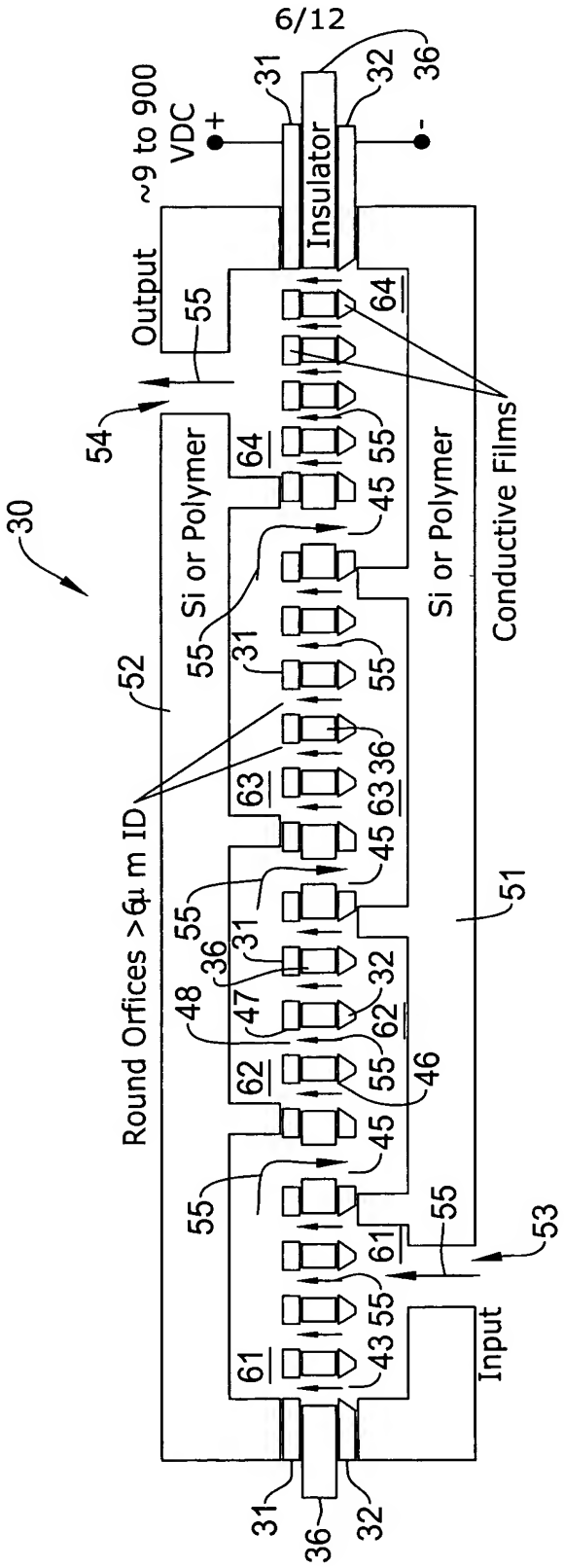
~9 to 900 VDC
+
-
Insulator
Output
Input
Si or Polymer
Si or Polymer
Conductive Films
Round Orfices >6μ m ID
30
31
32
36
51
52
53
54
55
61
62
63
64
45
46
47
48

Figure 6

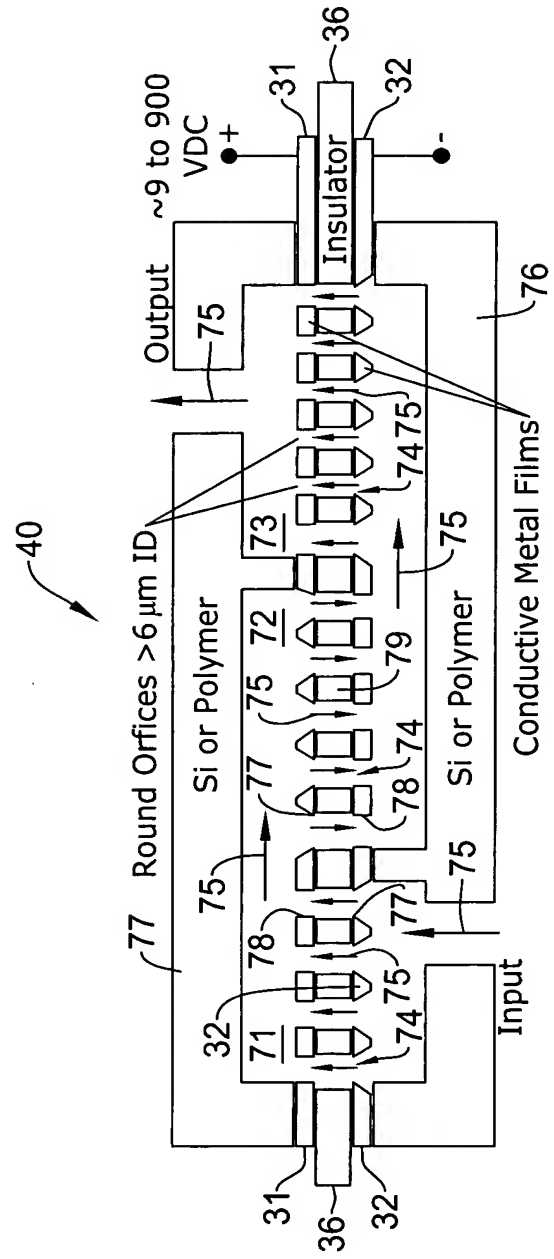
40
~9 to 900 VDC
+
-
31
36
32
Insulator
Output
75
76
Round Orifices >6 µm ID
Si or Polymer
Si or Polymer
Conductive Metal Films
Input
71
72
73
74
77
78
79

Figure 7

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Comparison of Performance Between Pumps Based on Different Technologies

Method -	Base Unit Size x N mm3	Frequency Hz	Power mW	Voltage V	Flow Rate cm3/min	Δp psid
Theoretical	-	DC	1.26	1.41	9.7	
Ion Drag	10 x 0.25 x 1 = 2.5	DC	1.65	401.41	9.7	
MesoPump (el.-static, future)	5x5x0.5x15 = 188	25	14	100	1.0	10
MesoPump (el.-static, today)	10x10x1x50 = 5000	3	25	150	1.0	10
MesoPump (el.-static, today)	10x10x1x50 = 5000	3	25	150	1.0	10
Piezo-Electric (fraunhofer)	7x7x1.1x7x14 = 5282	100		98		

Figure 8

Temperature Dependence of Ion Concentration

Temper. T in K	Ion Aff. Energy E(-) in J/mol 100,000 exp(-E/RT)	Ionizat.Energy E(+) in J/mol 1,000,000 exp(-E/RT)
600	2.239E-09	3.169E-87
1500	3.468E-04	2.514E-35
2000	2.541E-03	1.123E-26
2500	8.395E-03	1.739E-21

Figure 9

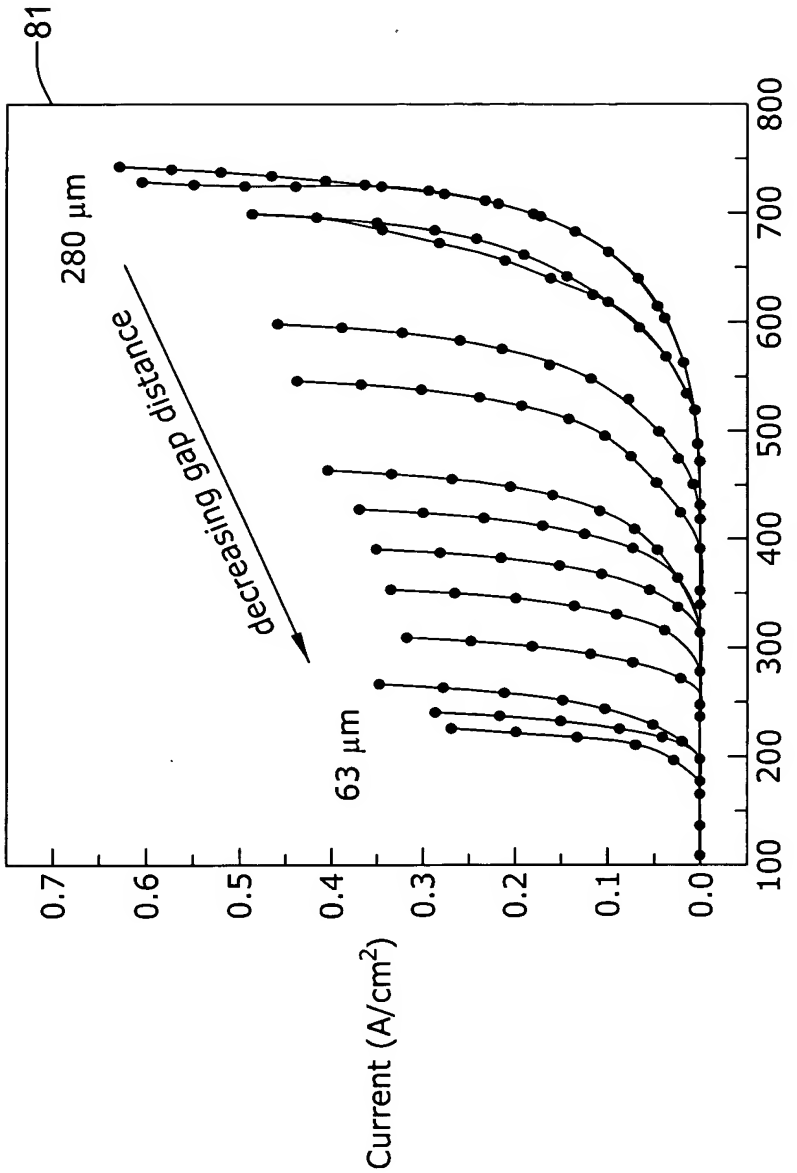
81
280 µm
decreasing gap distance
63 µm
Current (A/cm²)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Voltage (V)
100
200
300
400
500
600
700
800

Figure 10

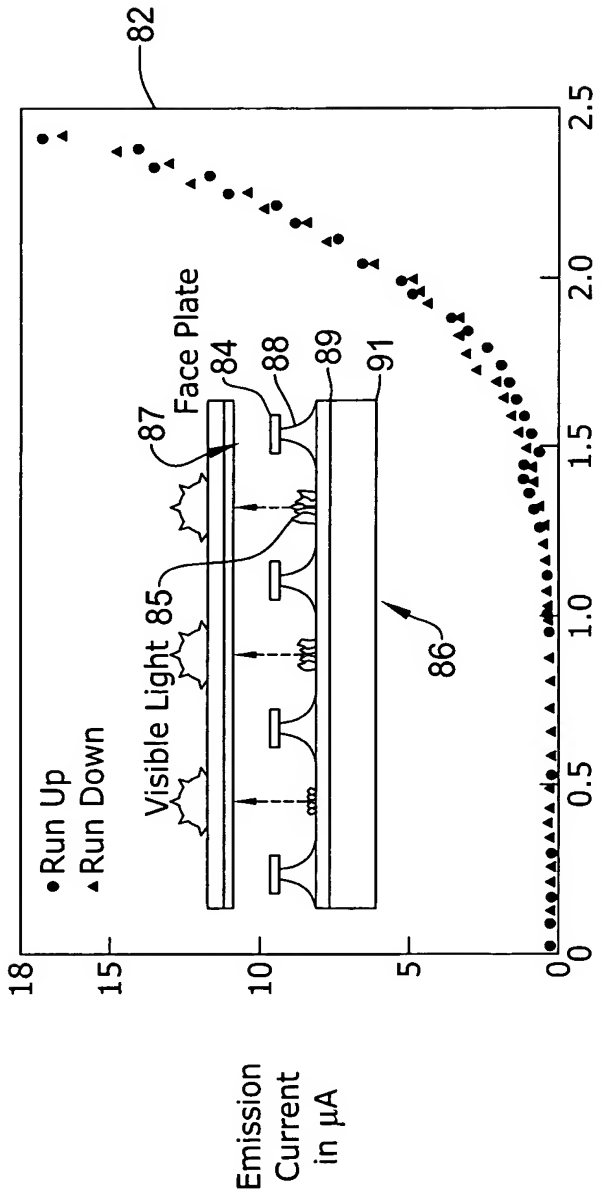
82
Face Plate
84
88
89
91
87
Visible Light 85
86
● Run Up
▲ Run Down
Emission Current in μA
18
15
10
5
0
0
0.5
1.0
1.5
2.0
2.5
Applied Voltage in kV

Figure 11A

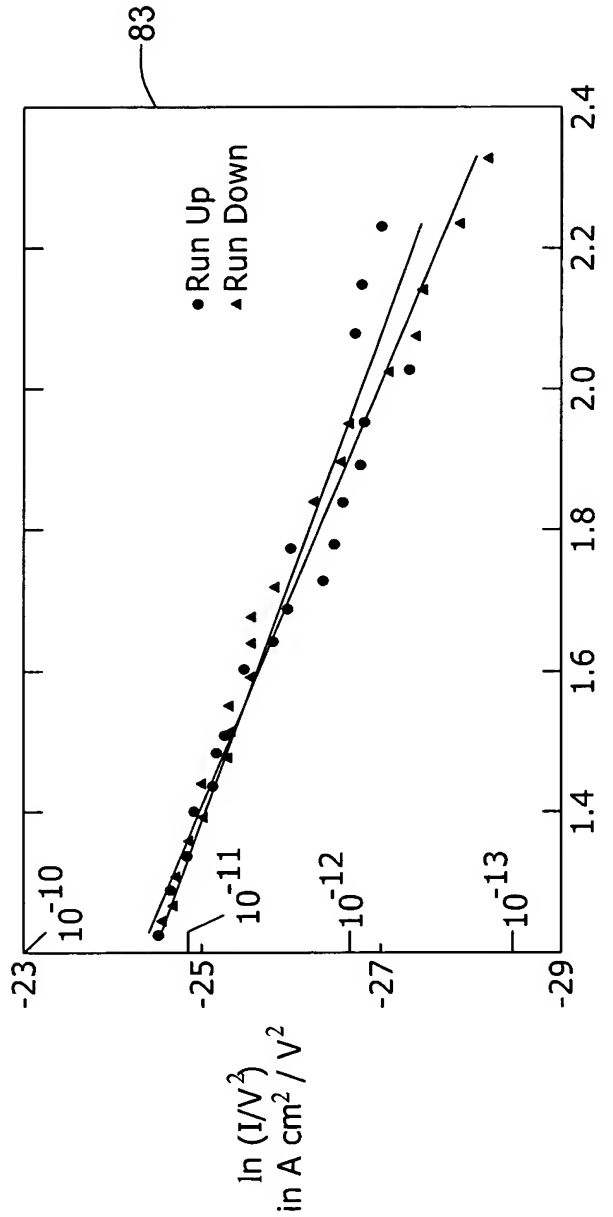
83
Run Up
Run Down
-23
-25
-27
-29
10^{-10}
10^{-11}
10^{-12}
10^{-13}
1.4
1.6
1.8
2.0
2.2
2.4
ln (I/V^2)
in A cm^2 / V^2
1/V in cm/V x 10^{-3}

Figure 11B